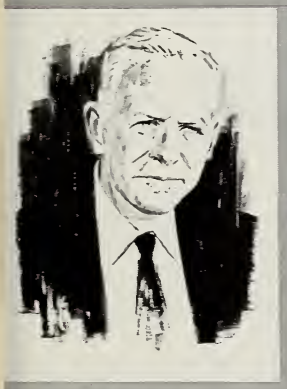
p. 6-7, Plum Island

AGRICULTURAL Research

June 1963/U.S. Department of Agriculture



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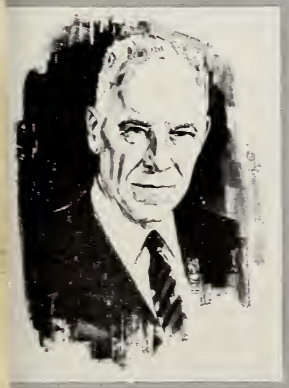

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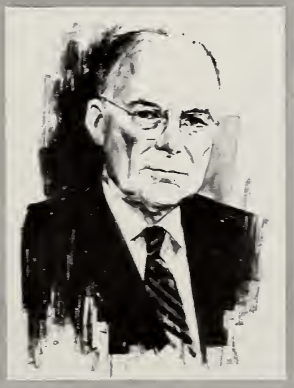

F. F. Smith

F. H. Spencer

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Research

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B. R. Blankenship, W. E. Carnahan, R. W. Doan, A. J. Feeney, E. J. Fitzgerald, D. W. Goodman, M. E. Haun, W. W. Martin, H. H. Smith.

For Superior Service

Our congratulations to the men and women of ARS who have earned the Department's Superior Service Award.

The list includes many scientists, an administrator, a research director, and an information officer. Success in any organized scientific effort depends on the kind of job that is done by those who manage, administer, and report, as well as on the work of the scientists themselves.

Still, the spotlight must be focused on the scientists. In the final analysis, it will be their talents that meet the complex challenges of agriculture.

For example, our scientists are learning how plant growth regulators work . . . how insects develop resistance to insecticides . . . how viruses reproduce and develop. They're investigating the physiology of wood formation . . . the physiological changes that take place in fruits and vegetables after they are harvested . . . the interaction of genes and hormones in the blood to form antigens . . . and the effect of light on plant growth and development.

Workers in agricultural research direct their knowledge and skills on practically all of the life and physical sciences. In seeking and finding the answers to agricultural problems, geneticists team up with nutritionists, agronomists with plant physiologists, soil physicists with engineers, and entomologists with chemists—to mention a few.

ARS, in return, is recognizing this effort by creating an environment where research specialists can do good work.

Scientists with initiative and ability have exceptional opportunities for personal growth and advancement on the job. They can move ahead on the strength of their scientific competence, without assuming administrative duties. They can broaden their outlook through work with world-renowned scientists, through training and travel, and through association with national and international organizations. And they are free to publish the results of their studies wherever they wish.

It is in this atmosphere that employees of ARS are doing their jobs—in superior fashion.

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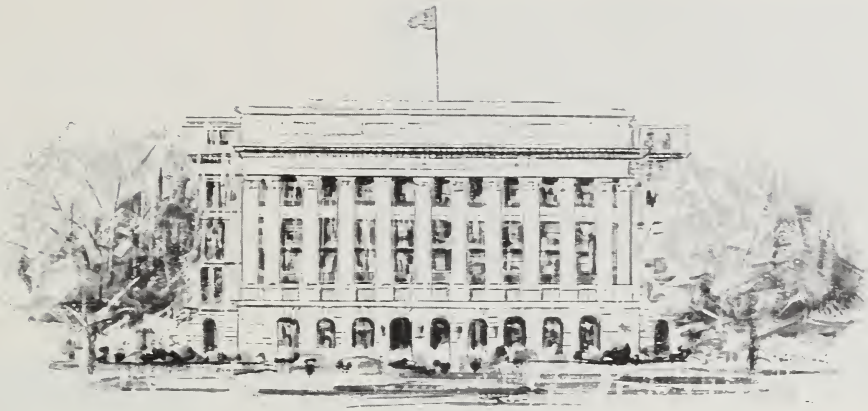
AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture



USDA Honors ARS Individuals, Groups . . .

For Superior Service

■ Superior Service Awards have been presented to eight individuals and six work units of ARS by Secretary of Agriculture Orville L. Freeman. The awards were made on May 17 as part of USDA's 17th Annual Honor Awards Program.

ARS Administrator B. T. Shaw pays special tribute to the Superior Service Award winners:

"It would be impossible to measure the contributions of these superior employees . . . These men and women are using their talents in many ways—as scientists, as administrators, as specialists. But whether we're talking about the scientist who made a discovery, or the regulatory man who first applies it, each is helping shape a stronger agriculture."

Superior Service Awards (Individuals)

Henry D. Barker, *Crops*, for outstanding leadership in planning, supervising, and developing measurements of the components of cotton quality, resulting in a significant improvement of the inherent quality of the national cotton crop.

Frank P. Cullinan, *Crops*, for inspirational leadership and stimulation of research in horticulture by distinguished scientific contributions and unusual administrative perception.

Laurence L. Layton, *Western Utilization*, for disclosing the antigenic complexity of castor-induced human allergies, thus facilitating development of allergen-free castor meal as a profitable feed; and for developing new techniques for the sensitive and specific determination of human allergies.

Paul C. Marth, *Crops*, for valuable and original contributions to science and the public through research on growth-regulating chemicals and for clarifying our understanding of how these compounds affect the growth, behavior, and physiology of plants.

John H. Martin, *Foreign Research and Technical Programs*, for outstanding scientific and research leadership contributions to wheat and grain sorghum improvement and for service to agriculture on a national and international scale.

Cecil M. Nichols, *Information*, for outstanding leadership and superior performance in developing and managing a program to communicate ideas from scientists to farmers through the ARS popular publications program.

Floyd F. Smith, *Entomology*, for productive research and inspiring leadership in developing effective, safe, and economical methods of controlling numerous insects and mites that limit the production of ornamental, vegetable, and greenhouse crops.

Frank H. Spencer, *Deputy Administrator*, for his contribution to the development and practice of sound management in the Department.

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For Superior Service

(*Continued*)

Superior Service Awards (Groups)

Linseed Oil Emulsion Paint Team, Northern Utilization, John C. Cowan, Marilyn J. DeVena, Lyle E. Gast, William L. Kubie, George E. McManis, Jr., John L. O'Donnell, Lambertus H. Princen, Wilma J. Schneider, Arthur W. Schwab, John A. Stolp, and Howard M. Teeter, for basic and applied scientific advancements leading to the development of commercially successful water-based emulsion paints from linseed oil.

Methods Improvement Fire Ant Laboratory, Plant Pest Control, W. A. Banks, F. J. Bartlett, P. M. Bishop, C. S. Lofgren, N. W. Pierce, and C. E. Stringer, for developing an effective insecticidal bait designed to eradicate imported fire ants without harmful effects to man or animals and without resulting in toxic residues when applied to agricultural areas.

Stretchable Cotton Fabric Research Group, Southern Utilization, Albert S. Cooper, Jr., Milton J. Hoffman, Alton L. Murphy, and William G. Sloan, for research in developing a process for the commercial production of all-cotton stretch fabrics by slack mercerization and for the discovery of a method for producing wash-and-wear stretch fabrics.

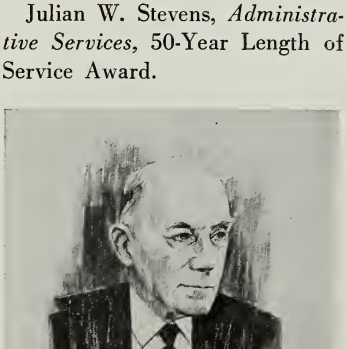
Tannage Investigations Group, Eastern Utilization, Martin L. Fein, Edward M. Filachione, Edward H. Harris, Jr., Joseph Naghski, and Wallace Windus, for an outstanding contribution to the utilization of hides through discovery of a new tanning process using glutaraldehyde by which improved shoe and garment leathers are now produced commercially.

U.S. Water Conservation Laboratory, Soil and Water, Herman Bouwer, K. J. Brust, William Ehrler, Leonard Erie, Gary Frasier, L. J. Fritschen, Ray Jackson, C. L. Jenson, L. E. Myers, F. S. Nakayama, R. J. Reginato, R. C. Rice, and C. H. M. van Bavel, for superior organization and development of a vigorous, well-rounded water conservation research program geared to the vital needs of the arid southwestern region.

Wheat Gluten Protein Characterization Team, Northern Utilization, Glen E. Babcock, Joyce A. Boundy, Helen Charley, James E. Cluskey, Robert J. Dimler, Floyd R. Huebner, Richard W. Jones, Harald C. Nielsen, Frederic R. Senti, Neil W. Taylor, and John H. Woychik, for pioneering scientific achievement in isolating and characterizing the component wheat gluten proteins, a major breakthrough in fundamental cereal protein research providing for future advances in wheat utilization.☆

50-Year Award

Julian W. Stevens, *Administrative Services,* 50-Year Length of Service Award.



Human senses do the judging on teams of researchers called . . .

TASTE

■ In an age of electronics—with its minutely accurate sensing equipment—the human senses still play an important role in research.

A panel of tasters, for instance, is an important research tool used by ARS scientists for such diverse jobs as devising improved methods of preparing food, developing new processed foods, and producing better livestock.

No piece of equipment has yet been able to match the ability of human senses—taste, smell, feel, and sight—in gaging the subtle differences in food flavors and textures.

Poultry requires less cooking

Taste-panel scores for tenderness, juiciness, and flavor show that today's young, tender poultry requires less cooking time than poultry of past years. Panel scores also indicate which cooking procedures will put the most satisfying turkey on the table.

In developing dry whole milk, ARS utilization scientists depend on panels of tasters to detect any off-flavors that might be given to milk during processing or storage. Processing variables that might affect flavor include the rate at which milk is fed into the dryer, the extent of the milk's concentration before drying, and the drying temperature.

PANELS

During development of products such as dehydrated potato flakes and flakelets, scientists have samples taste tested initially and during storage. These tests reveal the effect on flavor of various additives. They also indicate whether nitrogen packing or some other oxygen-excluding packaging procedure is necessary to insure satisfactory shelf life.

Additional ARS taste-panel research is devoted to meat tenderness—how the tenderness of beef, pork, or lamb might be improved through breeding or through feeding. Some work has been done on meat flavors. Taste panels are used to determine the effect of what an animal eats on how the meat tastes.

Marbling and beef tenderness

Tenderness studies by taste panels show that little relationship exists between tenderness and the amount of marbling in beef. This does not discount influences, however, that marbling might have on the flavor of a piece of beef.

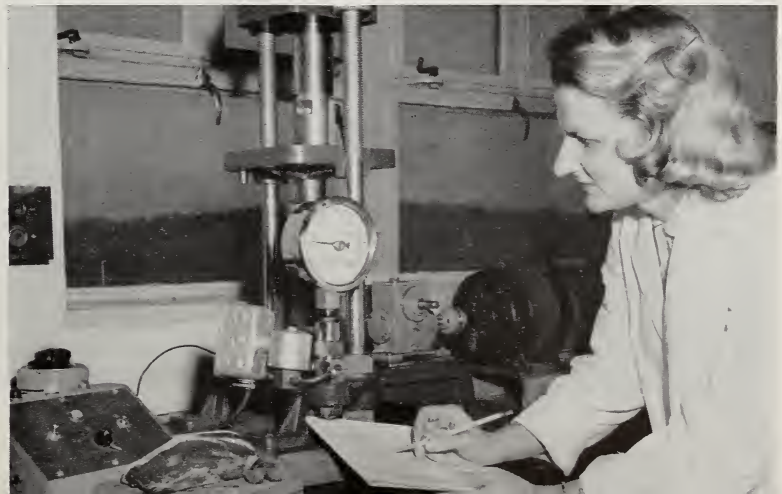
Taste panels have also been used to study tenderness of pork from hogs of varying degrees of leanness. Work so far indicates that pork from typical meat-type hogs, those bred and selected for meatiness, is somewhat more tender than pork from lean, run-of-the-mill hogs.

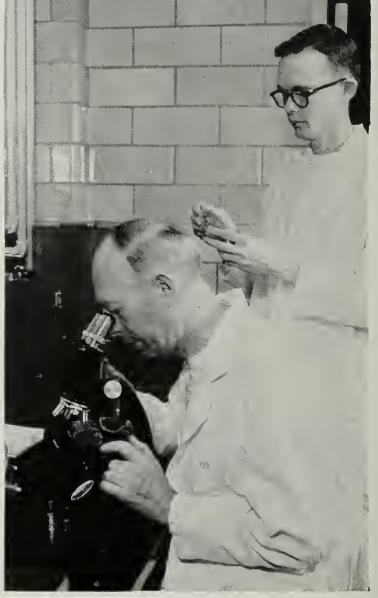
Tenderness devices save time

In research on meat tenderness, scientists still depend on these panels to accurately test steaks or chops for tenderness, but they consider simple mechanical devices sufficiently accurate and less time consuming in selecting tender-meated animals for breeding. So far, taste-panel tests for tenderness have been used as the standard against which mechanical devices are rated. Several devices now being used reach about 70 percent agreement with taste panels.

ARS scientists who supervise taste-panel tests make every effort to control conditions that might influence results. The carefully selected and trained panel members use individual booths while tasting food samples. The temperature and lighting of the room are kept constant. And the type and color of the container in which the samples are offered are kept the same throughout the testing—just to keep them from influencing the taster's decision.☆

Researchers rely on taste panels to check tenderness of meats, but they also use mechanical devices that are in 70 percent agreement with the panels.





C. J. De Boer (left) and T. J. Barber, of the Plum Island, N.Y., Animal Disease Laboratory, observe cultures of their weakened rinderpest virus.

A NEW DEFENSE AGAINST RINDERPEST

Plum Island, N.Y., scientists develop a vaccine to fight foreign cattle disease

Rinderpest has been one of the most devastating diseases of cattle since ancient times. It often kills up to 90 percent of exposed animals. During a particularly severe outbreak in the 1890's, it was estimated that more than 2½ million cattle succumbed in South Africa alone. The disease occurs in tropical Africa and in parts of Asia. Fortunately, rinderpest has never occurred in North America, but it represents a constant threat to our cattle industry.

Effective vaccines have been developed and are in use in rinderpest-infected areas. In these areas it is often possible to use vaccines of considerable virulence because there is some natural resistance in certain breeds of native cattle. In North America the problem differs because the cattle population is completely susceptible.

To protect highly susceptible cattle in areas such as North America, where rinderpest has never occurred, an experimental vaccine has been developed at Plum Island, N.Y., that appears to produce immunity without any ill effects on the cattle. This vaccine is similar to one developed by Walter Plowright of the East African Veterinary Research Oragnization at Muguga, Kenya, but it is believed to be an even more attenuated (weakened) form of the virus.

■ An experimental vaccine is undergoing intensive study by ARS scientists as a preventive measure against the deadly foreign cattle disease rinderpest.

Although this disease has never invaded the United States, increasing use of fast transportation between countries makes it impossible to guarantee that rinderpest—or any other dangerous foreign animal disease—will be kept out indefinitely.

Vaccine can be greatly diluted

Consisting of a living but weakened form of the rinderpest virus, the new vaccine is effective when diluted a thousand times. This characteristic would greatly simplify preparing large quantities in a comparatively short time, if the need should arise.

The vaccine was developed by C. J. De Boer and T. L. Barber at the Plum Island Animal Disease Laboratory, which is the ARS outpost for all research on contagious foreign diseases of livestock.

The scientists made the vaccine by modifying the rinderpest virus in a tissue culture. The virus was grown in cultures of calf kidney tissue, then harvested, divided, and passed on to fresh cultures. These passages greatly increased the amount of virus.

Mutant form is suspected

Tests following every second or third culture period showed the virus became more virulent during the first few passages; then it became less virulent during succeeding passages. This reduction in virulence led De Boer and Barber to suspect that a mutant, less virulent form of the virus was dominant and therefore in greater numbers in the culture medium.

To test this possibility, the researchers used the smallest number of viruses they could for each successive passage. They were able to gradually weed out the virulent viruses and, after six consecutive passages, pro-

duced a nonvirulent, modified vaccine that experimentally gave susceptible cattle protection from rinderpest without ill effects.

Modified virus gives immunity

Cattle inoculated with the modified virus were immune to strains of rinderpest virus from Kenya, Thailand, and Turkey, where the disease exists. This indicates that immunity to known strains of the virus can be derived from the use of the vaccine.

To find the dosage level necessary to produce immunity, the Plum Island scientists vaccinated cattle with undiluted vaccine and with dilutions that were increased tenfold up to one part per million. When challenged with virulent virus, cattle were immune if they had received one part per ten thousand of modified virus. Cattle died if they had received vaccine diluted to one part per one hundred thousand of modified rinderpest virus.

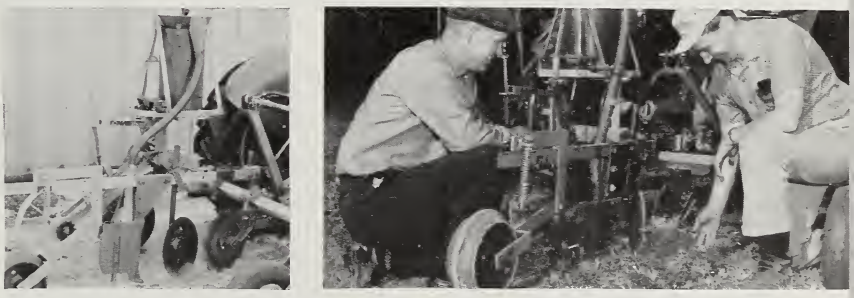
Although no failures have yet been experienced with the vaccine, trials with larger numbers of animals will be required to fully evaluate its effectiveness. These trials would be conducted under confined field conditions, in cooperation with some foreign country that is threatened by rinderpest disease.☆

SEEDING IN SOD

Readily available tillage tools are combined for renovating bluegrass pastures

■ Permanent bluegrass pastures can be renovated inexpensively with an ARS-developed tillage unit that—in one operation—scalps a 4-inch-wide strip free of sod, fertilizes, and plants small-seeded legumes.

Agricultural engineer H. J. Retzer of ARS and agronomist A. M. Decker of the Maryland Agricultural Experiment Station, College Park, got an excellent stand of birdsfoot trefoil in a bluegrass pasture by sowing the seed in rows 24 inches apart. They did it with three conventional tillage tools—a straight disk colter, a concave disk, and a spear-point furrow opener—all mounted on a tractor tool bar.



Conventional tillage tools have been combined in this new unit by its developers—A. J. Decker (left) and H. J. Retzer—for seeding in bluegrass sod. When in operation, a straight disk cuts a slit in the sod; then a concave disk scalps off a 4-inch strip of sod; next, a spear-point opener deposits seed and fertilizer in the sod-free strip; and, finally, a press wheel firms the seedbed. The components are mounted on the tractor tool bar.

Other equipment proved unsatisfactory

Conventional seeding equipment for use in sod proved unsatisfactory in bluegrass because the seed is sown in a narrow slit, and competition with the surrounding grass is too much for the emerging legume seedlings.

The straight disk colter cuts a slit 1 to 2 inches deep in the sod. Then the concave disk, with the cutting edge 4 inches to the left of the colter, finishes cutting the 1½-inch-thick sod strip and throws it to the side. The furrow opener, centered behind the two disks, applies a band of fertilizer, covers it with 1 inch of loose soil, and drops the seed on top of the soil. A press wheel is sometimes used to firm the seed into the soil.

Several units could be used

In this study, conducted at the Maryland station, the researchers seeded one row at a time. In actual practice, units could be added to seed several rows simultaneously.

The two disks and spear-point opener offer an inexpensive way of improving legume-deficient bluegrass pastures, Decker and Retzer say. This method eliminates the need of plowing under and reseeding an entire pasture. The improvements, usually done in the fall, can be made without the loss of valuable spring grazing. If managed carefully, the bluegrass can be grazed while the legumes are becoming established.☆

Research technician E. M. Cullen collects soil-solution specimens. The equipment draws samples from various levels in the ground.

RECLAIMING SODIC SOILS . . . . WITH

California scientists alter structure of soil with a succession of leachings

■ Reclaiming sodic soil with salt water—improbable as the idea may seem—works under laboratory conditions and now is being tested in field plots.

This reclamation method, using sea water or other concentrated salt water, was developed by ARS agricultural engineer R. C. Reeve and chemist C. A. Bower at the U.S. Salinity Laboratory, Riverside, Calif. It offers hope for restoring productivity to sodic (black alkali) soils on a permanent basis.

Large acreage is affected

Alkali and salt conditions affect productivity of about a fourth of the 33 million acres under irrigation in the United States and prevent farming of additional acreage. The ARS method also has potential application in other countries. For instance, sodic lands were reinstated as part of a planned irrigation project in Turkey after scientists there learned that these lands might be reclaimable.

To understand the method, certain background information is needed on the nature of sodic soils:

All soil particles have numerous sites or locations on their surfaces bearing negative electrical charges. Positively charged ions—principally sodium, calcium, and magnesium—are held at these sites. A sodic soil is one in which 15 percent or more of these sites are occupied by sodium ions. Depending on the percentage of sites occupied by sodium (called the exchangeable sodium percentage, or ESP), sodic soils support only tolerant crops or are worthless unless reclaimed.

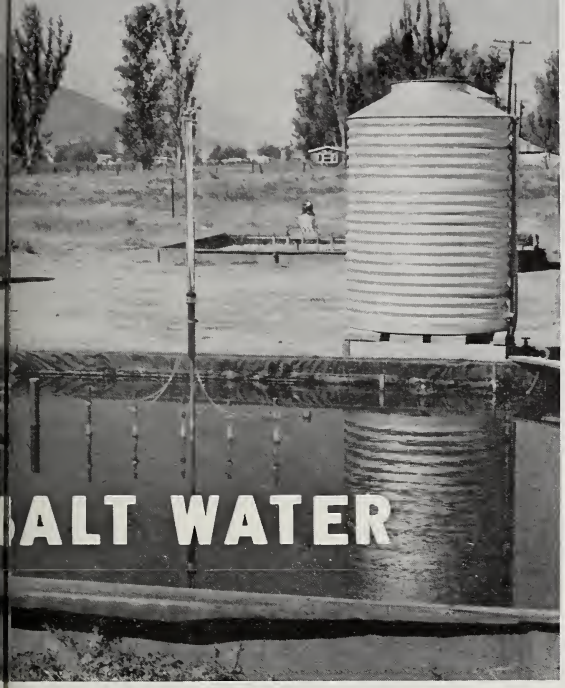
Sodic soils are practically impermeable to water. The sodium causes soil aggregates to swell and break apart when sodic soils are wetted. The resulting smaller particles fill the large pores or openings in the soil, and irrigation water cannot readily enter the tiny openings that remain.

These two characteristics of sodic soils have frustrated most reclamation attempts. Replacement of sodium with calcium requires leaching in the presence of a calcium source. However, because sodic soils are almost impermeable to irrigation water, known reclamation methods are either too slow to be practical or too expensive for use on low-value land.

The success of the experimental reclamation method hinges on two additional characteristics of sodic soils:

1. Leaching sodic soils with water *high* in salt concentration greatly improves permeability—even though low-salt water seals sodic soils. The salt acts as a flocculant, causing small soil particles to join in larger aggregates and leaving larger openings that more readily admit water.

2. Sodium ions (each with one positive electrical charge) do not adhere as tightly to soil particles as do calcium or magnesium ions (each with two positive charges). When the concentration of salt in the leaching water is changed, some calcium ions dislodge less strongly held sodium ions, and the leaching water carries away the freed sodium. Because calcium ions carry two positive charges, each of the calcium ions displaces two of



A general view of the U.S. Salinity Laboratory tests shows a few of the leaching plots used in the reclamation of sodic soil. In the plot in the foreground is equipment for extracting soil solutions and for measuring the hydraulic pressure at several depths in the soil.

Research technician Carl de Villar measures the water content of the soil by using a neutron-scattering meter.

This soil has been reclaimed by leaching with water containing calcium chloride.

the single charged sodium ions.

The scientists began laboratory tests of their new method by leaching with high-salt water to improve the soil's permeability. They followed this with six successive leachings, each with water of lower salt concentration, concluding with Colorado River irrigation water. This changing of the salt concentration caused the exchange of calcium ions for sodium ions.

Salt concentration was high

The first leaching was with equal parts of Salton Sea and Colorado River waters. Salt concentration was high; about 70 percent of the salt was sodium and the remainder predominantly calcium and magnesium. Although the *proportion* of calcium ions in the leaching water needed to displace sodium in the soil was low, the *number* was great because of the concentration of the solution. And each calcium ion replaced two sodium ions.

The seven successive leachings reduced the exchangeable sodium percentage, or ESP, from an initial 39 to less than 5—well below the minimum 15 percent ESP for sodic soil. This soil was reclaimed in 12 days, and its hydraulic conductivity (a measure of water movement through soil) after the leachings was a desirable 0.69 centimeter per hour.

Similar soil leached only with Colorado River water required 120 days for reclamation. And, although the ESP was similarly reduced from 39 to 5, this soil had a hydraulic conductivity of only 0.021 centimeter per hour. Though nonsodic, the soil was still nearly impermeable and unsuitable for cropping.

The method using high-salt water is now being evaluated under field conditions on test plots 15 feet square. The scientists have so far determined the rate at which water enters soil with four reclamation methods.

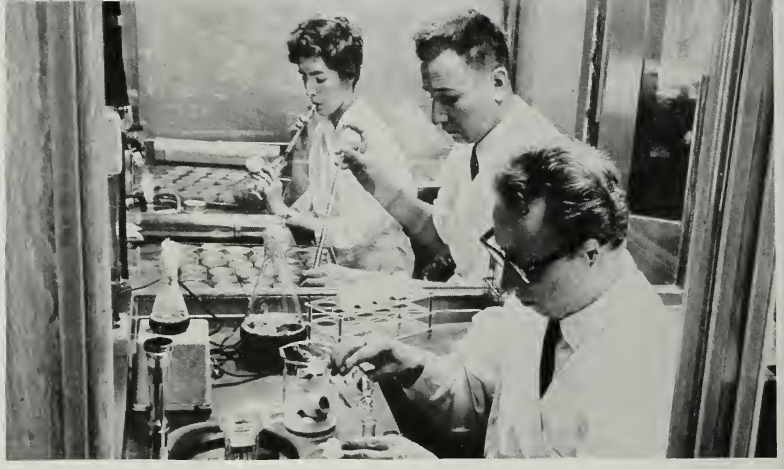
The fastest method, which is too expensive for practical application, uses progressively reduced concentrations of calcium chloride. The field test of this method showed that water entered the soil at the rate of 17 centimeters per day, and that the method thus would reclaim sodic soil with an initial ESP of 80 in only 10 days.

Land costs are considered

The new ARS method, which the scientists hope will be sufficiently economical for use on low-value land, showed an infiltration rate of 10 centimeters per day under field conditions. The first leaching was done with high-concentration salt water containing 78 percent sodium and 22 percent calcium salts. Seven leachings were required, each made with water of lower salt concentration than the preceding.

When leaching of plots was attempted with Colorado River irrigation water only, the infiltration rate was 0.2 centimeter per day. At this rate, the scientists estimate, reclamation would take 40 years.

The conventional method of leaching with a saturated gypsum solution was nearly as slow as the low-salt method—it had an infiltration rate of 0.3 centimeter per day.☆



Laboratory technicians prepare chick-embryo cells for use in diagnostic tests for leukosis—and for use in immunology studies of the disease.

GAINING ON LEUKOSIS

Tempo of research increases . . . scientists find that one virus may cause this dread poultry disease in many forms

■ Poultry scientists are becoming confident that a way soon will be found to control leukosis, the cancerlike disease of poultry.

A comment by poultry pathologist B. R. Burmester, who has studied leukosis for 20 years at the ARS Regional Poultry Research Laboratory, East Lansing, Mich., is indicative of the optimism being expressed: "In all the years of working on leukosis at this laboratory, I have never been as optimistic as I am now concerning a solution in the near future."

Leukosis is costly, complex

Many researchers consider leukosis the costliest of all poultry ailments and one of the most complex to solve. Control of leukosis would not only drastically reduce losses—estimated at $60 million annually—but the answers provided by poultry scientists might also prove beneficial to those studying cancer in man. The diseases are similar to the extent that both can be tumor producing and both are characterized by uncontrolled and rapid cell division and growth.

Burmester lists several research developments by ARS and State scientists studying leukosis that make the outlook for controlling the disease promising:

Recent study points to one agent

Results of a recent study suggest that a single virus—though it may vary in potency—causes the disease in its many forms. Virus from chickens infected with varying types of leukosis in 22 widely dispersed flocks was used to inoculate birds of a leukosis-susceptible line at East Lansing. The different sources of virus caused a wide variation in the amount of disease produced, but the types of disease were similar. The types were also similar to those caused by strains of virus previously isolated and studied extensively at East Lansing.

Researchers have found how to detect affected or virus-carrying birds by laboratory methods. Two means of detection are used; both are based on tissue culture procedures: A serum antibody test identifies some birds that are, or have been, infected and have produced antibodies against the disease. A virus-detection test identifies chickens that were infected as embryos—or shortly after hatching—and still carry the virus but don't respond to the serum antibody test. ARS scientists are making progress toward the development of a simple, reliable test for field use.

Much has been learned about how the virus is transmitted. It has been proved that the virus that causes visceral lymphomatosis, the most prevalent form of leukosis, can be transmitted from generation to generation by infected fertile eggs. The disease can also be transmitted by direct contact between chickens in the same pen (AGR. RES., August 1960, p. 3).

Limited success with vaccine

There have been experimental successes in vaccinating against leukosis in the laboratory. Burmester has vaccinated hens to make them and their offspring immune to virulent doses of lymphomatosis (AGR. RES., April 1955, p. 6). The vaccination procedure Burmester used, however, was laborious and expensive, and it has not proved effective in field trials.

In other basic studies at East Lansing, scientists have found that resistance to one type of leukosis (erythroblastosis) is inherited in some inbred birds (AGR. RES., November 1960, p. 12).

It has also been found that all the leukosis-causing types of virus that have been studied are composed mostly of ribonucleic acid and are nearly the same size—about 80 millimicrons in diameter with a nucleus about 40 millimicrons in diameter. The virus is very similar to other viruses causing disease in animals.

Since much basic progress has been made toward an adequate understanding of the complex disease, ARS poultry reseachers believe that increased emphasis now on practical control methods will hasten the day when poultrymen can effectively combat leukosis.

Facilities are being expanded

Two recent developments are indicative of the heightened interest in finding ways to control the disease: (1) Research facilities at East Lansing are being expanded. Construction begins this summer on a $450,000 addition to the laboratory. Director Berley Winton also anticipates boosting his research staff by four or five scientists. (2) Within the last 5 years at least half a dozen State agricultural experiment stations and medical schools have started leukosis research projects. Before that, only two or three had projects going.

This increased emphasis on leukosis research might result in an answer to a question that is perhaps a key to controlling leukosis: What is responsible for triggering a latent infection? The virus will often be present in chickens for a long time, apparently not causing any trouble. Then something happens, setting off rapid cell growth in one or more organs or systems of the body.☆

A Pesticide That Attracts Insects . . .

Lindane exhibits an unexpected quality

■ The well-known insecticide lindane showed unexpected attractant qualities when ARS scientists added it to a standard bait used to attract drosophila fruitflies.

Their object was to determine whether an insecticide could be added to drosophila bait without reducing its attractiveness to the flies. Fourteen insecticide formulations were tested by entomologists H. C. Mason and T. J. Henneberry at the Agricultural Research Center, Beltsville, Md.

Lindane powder proved best

Lindane wettable powder increased the bait's attractiveness. In fact, baits containing lindane wettable powder were the only ones that, at all levels of concentration, consistently attracted more drosophila flies than the standard drosophila bait. Differences between standard baits and those containing lindane wettable powder were almost always significant.

Emulsifiable lindane had the opposite effect. Baits containing this formulation attracted significantly fewer flies than the standard bait. Lindane was the only insecticide used both as a wettable powder and as an emulsifiable concentrate; all others were used only as wettable powders. Each of the 14 insecticide formulations was tested at concentrations of 0.25, 0.5, and 1.0 percent in a freshly prepared standard bait (1 percent of apple cider vinegar, 4 percent of active dry yeast, and 10 percent of granulated sugar, in water).

The scientists say further studies are necessary to determine the agent in lindane wettable powder that increases the attractiveness of the bait, as well as the agent in emulsifiable lindane that reduces the attractiveness of the bait.

Mason and Henneberry carried out their studies because results of previous field investigations indicated that baits containing insecticides had promise for controlling drosophila fruitflies on tomatoes. So far, however, no bait has been found that is attractive enough to be effective under field conditions.

A more likely prospect is using baits as a research tool. Effective baits may be used to detect the onset of a drosophila infestation, as a means of determining the intensity of drosophila populations in an area, and as a check on the progress of an experiment in controlling the flies.

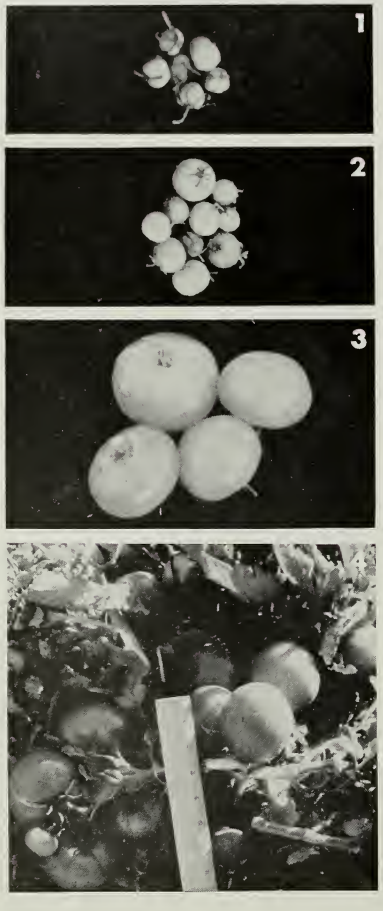
Species attack many crops

Several species of the fruitfly are important pests. None of the species has its own common name—all are commonly called drosophila flies. The ARS study was concerned specifically with *Drosophila melanogaster*, which sometimes causes heavy losses in tomato crops. If weather conditions are such that cracks develop in the fruits, the flies lay eggs in the cracks. The eggs and the larvae that hatch from them then make the fruit unmarketable. Drosophila flies also damage many other crops, including melons, figs, and grapes.☆

Now:

Tomatoes Resist Curly Top

Scientists overcome long-existent genetic barrier



■ A long-term breeding program to develop tomatoes with resistance to curly top virus disease appears to be making encouraging progress.

Crosses tested during the past 2 years indicate that breeders, after years of trying, are near success in incorporating good resistance to curly top into tomato breeding lines that have promising horticultural characteristics.

This optimistic report comes from ARS geneticist M. W. Martin and plant pathologist O. S. Cannon of the Utah Agricultural Experiment Station, which is cooperating in the program.

Development of tomatoes with a high level of resistance to curly top would open up the Intermountain area of the West to commercial tomato production. At present, the disease is a serious problem, particularly in this area. Losses vary from year to year (in some years they have been estimated at $2 million in Utah alone) and are so severe that tomatoes are not risked on thousands of acres otherwise well suited to this crop.

Three lines developed

Curly top resistance and good horticultural characteristics have been combined in three tomato lines, designated 22C2, (25 x 28) 193, and (45 x 28) 193. Each line derives its disease resistance from one or more species of wild green-fruited relatives of the tomato.

Fruits of the resistant wild species were collected in South America by the late H. L. Blood, a USDA plant breeder, who began the curly top program in 1930. Blood made his search among wild green-fruited types after trying for 10 years to locate a source of resistance among commercial tomato varieties.

Genetic barriers, however, have until now thwarted attempts to incorporate the high resistance of the wild species into breeding lines of commercial promise. The three new lines tested in Utah seem to have overcome these barriers.

In greenhouse tests during 1961 and 1962, Martin and Cannon report, 35 percent of all 22C2 plants (73 plants out of 207) remained healthy after exposure to leafhoppers infected with curly top virus. In line (25 x 28) 193, the portion of healthy plants was 45 percent (75 out of 165 plants), and in line (45 x 28) 193, 30 percent (41 plants out of 136) remained healthy.

Most control plants infected

In contrast, the virus infected all 23 susceptible check plants and 25 of 26 plants of Owyhee, a commercial tomato with some resistance.

In further greenhouse tests, Martin and Cannon found that crosses of the three new breeding lines with commercial varieties maintained the same high level of resistance to curly top that was present in the breeding lines.

For example, 38 percent (213 out of 559 plants) of a line 22C2-commercial backcross remained healthy during the 1962 growing season after exposure to infected leafhoppers. Forty-three percent (329 of 774 plants) of a line (25 x 28) 193-commercial backcross were not infected, and 36 percent of a line (45 x 28) 193-commercial backcross were not infected.

In contrast, none of the 184 susceptible check plants and only 5 out of 209 (2 percent) Owyhee plants remained healthy.☆

Steps in the development of resistance to curly top disease are (*1*) Lycopersican peruviamum, *the main source of resistance;* (*2*) *selected second-generation progeny from a cross between a commercial line and* L. peruviamum; (*3*) *selected curly-top-resistant breeding line; and* (*4*) *curly-top-resistant, commercial-type tomato.*

Irrigation water containing the radioactive gold flows out of the metering and mixing apparatus down gently sloping strips of land.

GOLD *A new soil research tool*

■ Gold 198, a radioactive isotope of the metal that made California famous a century ago, is proving to be an accurate research tool for measuring how much water enters the soil.

In California experiments, ARS scientists added gold 198 to irrigation water and then measured the amount of gold in soil samples taken from plots that were irrigated. The amount of radioactive tracer in the top 2 or 3 inches of soil was in direct proportion to the amount of water entering the soil.

Technique tested at Brawley

The radioactive tracer technique should be useful to scientists evaluating soil and water management practices, according to B. D. Meek, A. J. MacKenzie, and K. R. Stockinger, soil scientists who tested the procedure at the Southwest Irrigation Field Station, Brawley, Calif.

For example, radioactive gold could be used to determine how much water enters soil at different locations in a plant bed or at various points on the sides and bottom of a furrow.

Selection of gold 198 was dictated by one reason that would have surprised participants in the 1849 gold rush: it is low in cost. In addition, gold 198 is strongly adsorbed to soil and has a short half life (2.7 days), which limits the time an isotope is a radiological health hazard.

Tests on Holtville clay loam

The scientists added the radioactive tracer to irrigation water applied at four rates. They flooded uniformly sloping strips of land that were 3 feet wide and bordered by soil ridges along their 200-foot length. Tests were on Holtville clay loam soil.

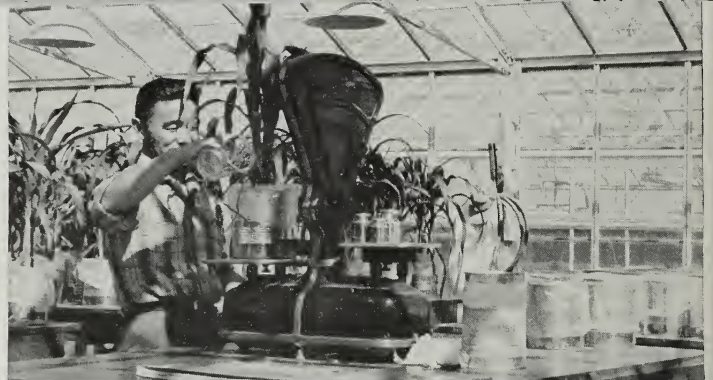
The experiments indicated another desirable quality of gold 198 for measuring water intake—it penetrates only a short distance into irrigated soil. Accurate readings consequently are possible from small soil samples. Although depth of penetration varies with the condition and texture of soil, sampling to a depth of only 6 centimeters (2.36 inches) is adequate in all but very sandy soils.

Tests also showed that the concentration of gold in irrigation water did not decrease appreciably as the water flowed the length of the strips, indicating that gold was not deposited on the soil surface. Such surface deposits would have made intake measurements inaccurate.☆

LEFT—A calibrated orifice box meters irrigation water into a vertical mixer along with the solution of gold 198, allocated through tubing from a Mariotte bottle (inside the can). RIGHT—B. D. Meek takes a sample of water to determine the concentration of gold 198 in the flowing water.

To reduce soil evaporation, scientists are using an alcohol product to create . . .

A DRY SOIL BARRIER



Soil scientists used plastic-lined containers of soil, treated with hexadecanol, in the evaporation studies. Weights were recorded to gage evaporation.

■ Preliminary findings by a team of soil scientists in Colorado suggest significant progress toward solving one of agriculture's most challenging problems—how to reduce loss of soil moisture through evaporation.

An estimated 123 million acre-feet of water evaporates annually from cropped and fallow land in the 17 Western States. This evaporation loss is about 43 percent of total annual water consumption of all homes, industry, and agriculture in the 48 contiguous States.

Laboratory investigations led by ARS soil scientist S. R. Olsen, in cooperation with the Colorado Agricultural Experiment Station, indicate hexadecanol, a commercial alcohol product, will restrict evaporation from soil.

Previously used on lakes, reservoirs

The product used contained 44 percent cetyl alcohol, 46 percent stearyl alcohol, and 10 percent other alcohols. It has previously been used to reduce evaporation from free-water surfaces such as lakes and reservoirs.

The scientists added hexadecanol to Weld loam soil in small laboratory containers, at rates of 660, 3,320, and 16,600 pounds per acre, by four methods: (1) Mixed with the surface quarter-inch of soil, (2) uniformly mixed with all of the soil (6.6 pounds in the container), (3) layered 1 inch below soil surface, and (4) layered 3 inches below soil surface. Containers of untreated soil were included in the test as controls.

The scientists added enough water to saturate the treated soil; then they measured the water lost by evaporation during 10 days. This 10-day cycle—saturating the soil and measuring evaporation—continued for 14 months.

The greatest evaporation reduction, 43 percent, resulted from the addition of hexadecanol at the 16,600-pound rate in the surface quarter-inch of soil.

Olsen explains that hexadecanol mixed in the surface soil restricts evaporation by drying the top layer of soil. Initially, hexadecanol probably slows the rate of capillary movement of water to the surface. It may also make the soil less able to hold water. In either case, the treated surface layer of soil dries out more rapidly. The dried surface layer then restricts evaporation by acting as a barrier to prevent the movement of moisture (as vapor) from soil to air.

The scientists observed no reduction in evaporation from any of the treated test containers during the first day after irrigating the soil. However, with the most effective treatment, the moisture content of the top quarter-inch of soil was reduced from 22.3 percent to 3.9 percent within 3 days. The surface layer of untreated soil still contained 21 percent moisture at this time.

Resists decomposition

Hexadecanol proved highly resistant to decomposition by microbial action. Part of the material remained in apparently unaltered form for 14 months after application at the highest rate. Hexadecanol is known to be nontoxic to soil micro-organisms at rates greatly in excess of those used in the experiments.

Scientists cannot yet predict whether hexadecanol would be an economical evaporation suppressant under farm conditions. Preliminary conclusions must be verified under field conditions, and further information is needed on the most effective rates and methods of placement of the material in the soil.

Further research also is needed on how hexadecanol affects soil structure and availability of soil nitrogen to growing plants.☆

Detecting sugarbeet yellows

The search for sugarbeet breeding lines with resistance to virus yellows may be simplified by a new screening method that determines the relative resistance of growing plants.

At present, one of the stumbling blocks to development of varieties resistant to this costly disease is the lack of a reliable way to gage the relative resistance of individual sugarbeet selections.

Research by ARS chemist J. M. Fife has shown that an accurate evaluation of resistance may be obtained by comparing the root growth of diseased and healthy plants, as measured by daily weight gain.

The best time to make these gain comparisons seems to be about 120 days after germination, although further research is needed to determine precisely the best testing time. Ideally, the measurements should be made during the period when the virus is exerting its maximum influence on the growth of the plant.

In one of his experiments at the U.S. Agricultural Research Station, Salinas, Calif., Fife inoculated plants of the US 75 variety with virus yellows 40 days after germination. At 120 days after germination he compared the root weights of the infected plants with those of healthy plants of the same age.

The growth rate of yellows-infected roots averaged only 1.07 grams daily per plant, compared with an average daily weight gain of 5.25 grams for healthy plants in the control group. The ratio of 1 to 5 in daily weight gains could be called a relative resistance index, Fife suggests. By multiplying the ratio by 100, the index figure for Fife's experiment would be 20. A relative index figure of 100 would indicate that the disease had no effect on roots under the conditions set up in the California research.

Mechanical honeycomb uncapping

A public service patent has been granted to an ARS agricultural engineer for a machine he invented to speed up uncapping of honeycombs.

Bees fill the cells of their combs with honey, then cap them with wax to hold the honey in the comb. The wax capping must be removed or punctured before the honey can be extracted.

For the initial operation, the new machine has a pair of heated, aluminum rollers with teeth that punch holes in the wax capping when the honeycombs are passed between the rollers. It will uncap both sides of 20 honeycombs in a minute.

Beekeepers can now uncap only 8 to 10 combs a minute, using an electrically heated knife to slice the wax off the comb. In this process, the wax becomes mixed with the extracted honey and must be separated later.

After the comb has been uncapped, either a second pair of rollers or a set of metal fingers roughens the wax surface so that the comb can be used again. C. D. Owens, inventor of the machine, says that the bees will not refill a comb if the surface of the comb is too smooth. Instead, they recap the still empty cells.

Each roller, 3 inches in diameter and 17 inches long, has more than 3,200 metal teeth. Wax and honey do not stick to the rollers during uncapping because they are heated to 120° F. or higher.

Owens says that a machine equipped with these rollers can be made at less cost than a machine with a knife, and that the rollers do not need sharpening. The rollers uncap a standard 17-inch honeycomb.

Because honeycomb frames are made of wood, moisture sometimes causes them to swell and jam the uncapping machine. Owens is developing a plastic frame to overcome this problem. He is working at Tucson, Ariz., in cooperation with the Arizona Agricultural Experiment Station.

Slows wilting and ripening

One rotten apple in the barrel may be a greater culprit than the author of this time-honored saying realized.

Two USDA scientists think so. In a recent series of preliminary tests of a method to prolong the life of cut flowers, they found an interesting link with other research—on the ripening of stored apples.

Here's the story:

ARS plant physiologist Sam Asen and physiologist Morris Lieberman of the Department's Agricultural Marketing Service have shown that delaying the opening of cut roses by treating them with ethylene oxide gas may have excellent possibilities as a technique for the florist industry.

They learned that holding cut roses for 20 hours in a sealed atmosphere containing 0.25 percent ethylene oxide prevented complete opening of the buds for as long as 70 hours after treatment. Untreated rosebuds were completely open 40 hours after cutting.

The research is still in the early stages, and much remains to be done before commercial application of

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ethylene oxide can be recommended, Asen and Lieberman say.

The experiments with cut roses are a natural sequel to research by Lieberman on the basic principles involved in the aging of stored fruit. Last year, Lieberman and an English scientist, L. W. Mapson, found that they could delay the ripening of green tomatoes 5 to 21 days by holding them in an atmosphere containing ethylene oxide. This work was done at the Low Temperature Research Station at Cambridge University in England.

Because of the work with ethylene oxide and fruit, it was decided to experiment with the effects of the gas on cut flowers.

"We got into these studies because of our knowledge of another gas—ethylene," Lieberman explained. "We have known for a long time that the ripening process in fruit—tomatoes, pears, apples—is involved somehow with production of ethylene in the fruit. When apples are held in storage, for example, the high ethylene production by one ripe apple in the barrel may hurry ripening of others.

"Last year in the course of studying ethylene formation by fruit, we identified ethylene oxide from volatiles obtained from apple tissue. We then discovered that exposing fruit to ethylene oxide caused the reverse of the effect produced by ethylene. This surprised us because we thought that the ethylene oxide might tend to speed ripening like ethylene. Instead, it appears to delay ripening."

At present, the way that ethylene and ethylene oxide work in plant metabolism is not known. The efforts of the scientists are now directed toward finding that out. The results of this work may eventually be useful for increasing the keeping quality of horticultural crops after harvest.

Treated roses—84 hours after cutting—were still in the bud stage. Untreated roses had wilted and lost all their beauty.

Foresters use friendly insects

During the last 6 years, the U.S. Forest Service has introduced 22 foreign species of insect predators into the Pacific Northwest in an effort to find a biological control for the balsam woolly aphid, a serious pest of true firs. Five of the 22 predators appear to have become established.

The most promising of these is a small beetle, *Laricobius erichsonii.* Populations of this beetle have been increasing steadily in five of eight areas where it was liberated, and the predator's life cycle is well coordinated with that of the aphid, on which it feeds.

This beetle significantly reduces balsam woolly aphid populations, but it tends to concentrate on trees that are heavily infested. It also has a tendency to spread very slowly. The greatest distance it has dispersed in the last 5 years is 3,500 feet from release points.

To compensate for the predator's slow rate of spread, the Forest Service plans to liberate more *Laricobius* beetles in 1963.

Other foreign insect predators established in the Pacific Northwest for control of the balsam woolly aphid are a ladybird beetle and three species of small flies. These four predators have survived 2 or more years in their new environment, and all have characteristics which could make them valuable additions to the biological control program. Several native insect predators also are attacking the aphid.

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